

A STUDY OF MUNICIPAL AIRPORTS

by

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## AERONAUTICS

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"For I dipped into the future as  
human eyes could see,  
Saw the vision of the world and  
all the wonder that would be--  
Saw the heavens filled with commerce,  
argosies of magic sails,  
Pilots of the purple twilight, drop-  
ping down with costly bales."

---Tennyson---

## P R E F A C E

The great epoch of civil air transportation has come since the World War. Although the Wright Brothers demonstrated to the world at Kitty Hawk more than a quarter of a century ago that man could fly, it was only after the great crisis of 1914-1918 that the world gave attention to the development of air transportation for all civil purposes.

Unfortunately, this development has been so rapid that the public has not been able to keep pace with its values and progress. The public lagged behind in providing ground facilities, which constitute one of the most important phases of civil aviation. Airports have not been established as rapidly as necessary to provide the safety and convenience which are fundamental to the complete success of this new system of transportation.

When the public realized that airports were as necessary to air transportation as harbors and docks and stations and railroad yards were to marine and rail transportation respectively, it began to develop this much needed facility of air transportation.

While at present there are more commercial air-

ports than municipal airports, the latter, for reasons set forth in Chapter I of this study, are constantly growing in favor. Thus the municipal airport has become a problem which the writer has undertaken to study. As a result of his investigation and research the following chapters are presented.

The recency of the problem rendered several difficulties inevitable. Among these was the limited amount of available and comprehensive material, such as books and articles that bear upon the subject. A second handicap resulted from the fact that requests for information, which were addressed to various aviation experts and aviation publications, were in many instances not answered with the desired details.

Hence, the writer hopes that later studies and researches may be more comprehensively and fruitfully accomplished, and if this thesis shall have served as a cue to the importance and significance of the problem, the efforts, time and energy that have been devoted to its preparation and completion will not have been considered in vain.

A. A. Asis.

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## C O N T E N T S

Chapter		Page
I	DEVELOPMENT OF MUNICIPAL AIRPORTS	
	The Need for Airports in General.....	7
	The Demand for Municipal Airports.....	9
	The Growth of Municipal Airports.....	11
	Improvements of Municipal Airports.....	14
	Analysis of Buffalo Municipal Airport.....	16
	Airport Rating Regulations.....	17
	Factors in the Growth and Develop- ment of Municipal Airports.....	19
	(1) The Airport Committee of the Department of Commerce.....	20
	(2) Improved Aeronautics.....	21
	(3) The Recognition by the Laws, Courts and Authorities.....	22
	(4) Other Fundamental Factors.....	23
	How Municipal Airports Have Been Developed.....	25
II	THE MUNICIPAL AIRPORT - A "PUBLIC PURPOSE"	26
	State ex. rel. Hile v. City of Cleveland.....	27
	City of Wichita v. Clapp.....	29
	Doughty v. Mayor and City Council of Baltimore, Maryland.....	31
	State ex. rel. City of Lincoln v. Johnson.....	31

## C O N T E N T S

Chapter	Page
Dysart v. City of St. Louis, Mo.....	32
Ennis v. Kansas City, Mo.....	32
Hesse v. Roth, New York.....	36
McClintock v. City of Roseburg, Oregon.....	37
Conclusion.....	38
 III THE MANAGEMENT AND MAINTENANCE OF MUNICIPAL AIRPORTS	
Who Should Manage the Airport?.....	39
Park Department Administers the Municipal Airport.....	40
A Separate Department of Aviation.....	41
Other Methods of Management of Airports.....	42
The Manager and His Qualifications.....	42
The Place of Women in Airport Administration.....	43
Airport Field Rules.....	44
Financial Maintenance of Municipal Airports.....	49
Airport Revenues.....	49
Other Sources of Income.....	53
 IV AIRPORT FACILITIES AND EQUIPMENT.	55
Essential Equipment Needed.....	55
(a) Buildings for Administration and Operation.....	56

## C O N T E N T S

Chapter	Page
(b) Transportation Facilities.....	58
(c) Communication Lines.....	59
(d) Meteorological Instruments.....	59
(e) The Runways.....	60
(f) Drainage System.....	62
(g) Wind-direction-Indicator.....	63
(h) Lighting System.....	63
(i) Markings.....	67
(j) Fire-Fighting Apparatus.....	67
(k) Signs.....	68
(l) The Siren.....	68
(m) Airway Maps and Airport Records.....	69
(n) Other Maintenance and General Equipment Facilities.....	69
Bibliography.....	70
Tables:	
I ESTIMATED COST OF MUNICIPAL AIRPORTS.....	15
II HOW MUNICIPAL AIRPORTS HAVE BEEN DEVELOPED.....	25
III AIRPORT MAINTENANCE.....	48



## CHAPTER I

## DEVELOPMENT OF MUNICIPAL AIRPORTS

The Need for Airports in General: Airports have been defined as localities either of water or land, which are adopted for landing and taking-off of aircrafts and which provide facilities for shelter, supply and repair of aircraft; or places used regularly for receiving or discharging passengers or cargo by air.<sup>1</sup> The development of modern airports has been due to three fundamental factors: (1) their necessity as adjuncts of civil aviation,<sup>2</sup> (2) the inadequacy of early forms of landing fields,<sup>3</sup> (3) the demands of patrons for modern convenience of air transportation.

It is obvious that airports are necessary adjuncts of civil aviation. They not only serve as points of call

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1. Air Commerce Bulletin No. 2, Aeronautic Branch, Department of Commerce, Washington, D.C., April 1928.
  2. Kelly points out that the future of aviation rests on the ground (airport). It is there the planes must take-off and land. It is there the passengers' confidence must be inspired. It is there that foresight today will mean the saving of millions of dollars tomorrow. And it is there that experience and vision must be merged to put aviation on a solid foundation. Kelly, F., Tomorrow's Airport. Nation's Business XVII: 31.
  3. Duke, D., Airports and Airways. p. 3-8.

along an airway for purposes of shelter, supply, repair, or discharge of cargoes and passengers, but also, they facilitate the development of air commerce and transportation.<sup>4</sup>

Undoubtedly the demand for modern airports has been due to the inadequacy of the early types of landing fields, which were airports of the "find one if you can" variety, improvised from cow-pastures. The dangers that were inherent in these early forms of aviation fields have caused the loss of enormous sums of money and the sacrifice of many lives.<sup>5</sup> Because of this condition, which did nothing but hinder and hold back the development of civil aeronautics, better and more adequate airports were

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4. The significance of air transportation to modern civilization is well stated by Hager. He says: "Without doubt the chief factor in the development of modern civilization has been that of rapid transportation. Even in ancient times the greatness of an empire was determined by its transportation facilities. Rome had her wonderful roads. Carthage her powerful navy. The greatness of the British Empire is dependent solely upon its maintenance of her marine power. Railroads and automobiles have each played their stellar roles in the development of the United States until today it enjoys the position of being the wealthiest and most progressive nation on earth." Hager, A.B., New York's Municipal Airport. Airport 1:27, June 1928.

5. Duke, A., op. cit. p. 3-8, Ronald Press and Co., 1927.

considered, and ultimately materialized.<sup>6</sup>

The demand for airports came not only from pilots and aviation promoters, but also from the patrons of air commerce and transportation. This demand probably grew out of the fact that the early forms of landing fields frequently were not provided with adequate facilities and equipment for modern needs. The patrons declared their desire for modern conveniences and comfortable stations, to which the airport officials responded favorably by developing and improving the airports.

The Demand for Municipal Airports: Of all forms of ownership (Federal, Commercial, private and municipal) the municipally owned airport has won most favor because of the following reasons and advantages: (a) The municipality is represented in matters pertaining to aviation; (b) The municipality participates in the benefits of air commerce both in its application as a means of transportation and with reference to its utility in the community; (c) It enables the community to share in the benefits that are yet to come

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6. Byrd, R.C., cited in *Wichita v. Clapp*, 263, Pac. 12; Supreme Court of Kansas decided January 7, 1928: "The one outstanding need now is sufficient landing fields. I consider it the duty of every city to establish a field. Cities that hold back in the matter of providing landing fields are holding back aviation naturally."

from the development of air transportation:<sup>7</sup> (d) The dangers of monopoly and high charges of private ownership is eliminated;<sup>8</sup> (e) The municipal airport facilitates the advancement and development of aeronautics;<sup>9</sup> (f) It plays an important part in the building of the community and the gathering of people as the sail boat, steamship, railroad and automobile have done;<sup>10</sup> (g) It will enable the locality to retain its place in the industrial competition which is sweeping forward in a test of civic strength, and the right

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7. Duke, A., op. cit. p. 7.

8. McCracken, W.P., Who Shall own and Operate the Airports. American City XXXIX: 11. In this article he claims that the municipality should own and operate the airports. For instance he says: "It is highly important to the development of every community that at least one centrally located airport be available for general use, and this can be best accomplished by vesting its ownership in the municipality. Turning this responsibility to an air transport company would be like turning over its harbors, or the entire waterfront to a single steamship line. Such a policy would be regarded as contrary to public policy, if not altogether ridiculous. The evils of private ownership, such as monopoly and high charges could be avoided by public ownership. It is the duty of every municipality to own an airport, just as much as it is its duty to own and maintain the streets, parks and harbor facilities within its limits."

9. Weyerbacker, R.D., Airports. Saturday Evening Post. 201: 1-11, February 1929.

10. Hill, C.W., Atlanta Must Develop Its Airport. The City Builder, December 1927.

of the community to commercial life;<sup>11</sup> (h) It renders an educational value to the people in the community as well as to others;<sup>12</sup> (i) The municipal airport is easier to establish and be more fully equipped than other kinds of airports due to the frequent availability of funds for financing those projects;<sup>13</sup> (j) It adds beauty and pride of the community;<sup>14</sup> and lastly, (k) It provides recreation facilities just like European airports at the present writing.<sup>15</sup>

The Growth of Municipal Airports: The growth of municipal airports has been tremendous. Not only has there

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11. Arthur, W.E., Airports and Landing Fields. Annals American Academy of Political Science, 131:56. Consistently maintaining that cities must build their own airports, Arthur decrees: "If cities must continue to retain their place in industrial competition which is sweeping forward in a test of civic strength and the right of the communities to commercial life, the cities must build their own airports. The city without an airport will be in the same class as a coastal city without a well equipped harbor. Within the last years, commercial aviation has emerged from the obscurity of doubt and uncertainty to a condition of fact which challenges the attention of all. We stand upon the threshold of flying. Given some place to start from, some place to go to, and a route over which to fly, an airplane will develop the cities and communities which it flies."
  12. Wilson, R.E., Airports to Serve the City. Airports 1:16, September 1928.
  13. Whitnall, C., Municipal Airports. National Municipal Review XV: 104, 1926.
  14. Weyerbacher, R.D., Airports. Saturday Evening Post, 201:1-11, February 1929. Also Kelly, F., Tomorrow's Airports, Nation's Business XVII:31.
  15. Maskey, F.L., Amusements. Airport 2:16, March 1929.

been a great increase in numbers but, further developments and improvements have been made upon those already established. This trend has been so manifest that it is not undue optimism to predict that more and more progress may be expected in the future.<sup>16</sup>

The first attempt to take a census of airports was made by the United States Army Air Corps in 1926. It reported that out of the 915 airports in the country, there were 409 municipal airports. This total is greater than the number of commercial airports, which was 297 and also more than the Federal airports which showed a total of 209. It is therefore evident from this data that even during the very incipient stage of airport development, municipal airports increased more rapidly than other kinds of airports. But in spite of this remarkable growth, the number of municipal airports reported in the next year decreased, due to the rating procedure that became effective during that time.<sup>17</sup> This re-rating affected the other types of airports also as seen from the following figures collected by the Department of Commerce.<sup>18</sup> For that year there were reported

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16. Cline, R.A., Apathy or Airport. The City Builder, December 1928. Air Transport Growth. Aviation, March 16, 1928.

17. Air Commerce Bulletin No. 1, Department of Commerce, Washington, D.C., March 15, 1928.

18. Ibid.

582 airports in contrast to 915 in the past year. This made a loss of 36% over the preceding year by re-classification. Of the total number of airports on the new rating basis, there were 240 municipal airports, 79 Federal airports, and 263 commercial airports.

The standardization of airports in 1927, instead of discouraging them, made the municipalities more interested and enthusiastic in the building of their own airports. This eagerness and enthusiasm was shown by the fact that more was accomplished with regard to the construction of municipal airports in the following year, which showed a total of 412 municipal airports out of the 884 airports reported for all types (391 Commercial and 81 Federal) or an increase of 41%. This increase was very astonishing inasmuch as it almost doubled the quota of the preceding year, despite the fact that the rating procedure required higher standards.

Continued growth and improvement were manifest in 1929.<sup>19</sup> With the progress of all phases of civil aviation, the development of the municipal airports was considered as important as that of the Federal and commercial airports. A statement for that year shows that there were 1031 airports, of which 458 were municipal, 82 Federal and 491 commercial.

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19. Aircraft Age, February 1930.

The increases in the various airports from the preceding year show 46 municipal, 1 Federal and 100 commercial, or 10%, 1% and 20% respectively.

Improvements of Municipal Airports: It now remains to ascertain whether improvements upon municipal airports have been commensurate with their rapid increase. The improvement of any project is determined by the amount of money that is invested for that purpose and the municipal airport is no exception. It's apparent development can best be seen from the expenditures that have been devoted to that particular accomplishment. From that angle, one is led to the conclusion that continuous improvements had been made. For instance, the data which was secured in 1927 on 68 airports of various sizes located along contract Air Mail routes indicated an aggregate investment by the cities concerned of over \$17,000,000, an average cost of \$210,415 per field and \$46,912 for improvements.<sup>20</sup>

Data secured from fifteen representative airports for the same year likewise showed that in these fifteen municipal airports there had been invested the enormous amount of \$673,800 for improvement purposes, an average of \$44,920 per airport.<sup>21</sup>

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20. Duke, D., op. cit. p.32.

21. Ibid, p.33.



More recent estimates of expenditures for the newer and more modern types of airport show that tremendous investments for airport establishment and development have been made. And probably there is sufficient reason to believe that the improvement item is perhaps the biggest part of the total. These estimates range from \$50,000 for El Paso, to \$5,000,000 for Detroit. The total estimates for all these cities is \$19,039,000, an average of \$1,119,941 per airport. The following table will show these figures of the individual cities reported:

\*TABLE I

## ESTIMATED COST OF MUNICIPAL AIRPORTS

City	Cost
1. Detroit	\$5,000,000
2. New York	2,500,000
3. Baltimore	1,500,000
4. Cleveland	1,250,000
5. Newark	1,250,000
6. Portland	1,150,000
7. Oakland	1,000,000
8. Buffalo	1,000,000
9. San Diego	1,000,000
10. Columbus	850,000
11. St. Paul	750,000
12. Tampa	750,000
13. Cincinnati	500,000
14. Chicago	274,000
15. Dallas	140,000
16. Waco	75,000
17. El Paso	50,000

Analysis of Buffalo Municipal Airport:<sup>22</sup> The facts regarding the costs of various facilities and equipment of

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22. Duke, D., op. cit. p. 34.

an airport can be more clearly understood by the analysis of the Buffalo Municipal airport, presented below:

THE ACTUAL COST IN DETAIL

Land 518 acres	\$411,000.00
Building 3 hangars, 1 garage, 1 adm. bldg.	95,778.00
Runways (2 cinders 3,000 ft. long & 100 ft. wide)	48,528.56
Grading and processing	47,875.32
New roads	9,148.18
Drainage	33,549.00
Paving	27,453.17
Underground piping and electrical equipment	17,567.20
Rolling stock and parts (1 service truck, 1 five-tone carry all, 1 light delivery truck, 1 coupe, 1 grader)	14,123.81
Office equipment and supplies	2,563.05
Insurance	6,039.05
Store room supplies	709.21
Telephone and light during construction	671.23
Machinery and tools	9,580.58
Miscellaneous labor and supplies	2,569.72
Total	<u>\$727,156.08</u>

The yearly estimates of the Department of Commerce for the entire country regarding the development of municipal airports, further indicate that apparently more support is being given to their improvement. For instance, for the year 1929, it was estimated that approximately \$200,000,000 were spent for that purpose. And this year (1930) it has already been estimated that around \$300,000,000 will be invested for the same accomplishment. With an increase of \$100,000,000 or 50% above the preceding year to be devoted to carrying on this progress, the improvement of municipal airports is not only apparent but real.<sup>23</sup>

Airport Rating Regulations: The rating procedure of 1927 undoubtedly played a considerable part in stimulating these developments and improvements of the municipal airports. The fact that it required definite standards to be achieved before the aviation field should be accepted as fit and safe for aeronautic purposes, induced the munic-

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23. Estimates made by Blee, Assistant Secretary of Aeronautics, Department of Commerce, Washington, D.C.

ipalities to modify and improve their airports.<sup>24</sup> The 1927 basic requirements are briefly summarized as follows:

(1) Field or landing area should be firm and approximately level, with suitable approaches, well drained, and without obstructions or depressions hazardous to taking-off or landing; with at least two landing strips 100 feet or more wide, crossing or converging at not less than 45 degree angles. These must permit safe landing in ordinary weather. If the sod or turf is not tough and hard enough for these purposes, the landing strips must be of cinders, slag, gravel, asphalt, or other suitable material, in which case they are called runways.

(2) There must be a margin of at least 100 ft. clearance between the landing strip edges and field boundaries.

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24. Airport Rating Regulations is divided into four parts: Part I involves the general procedure, penalties, and waiver of regulations; Part II Rating of Airports for land planes includes, basic requirements such as suitable landing area, freedom from obstructions, accessibility, wind-direction-indicator, markings, runways, drainage, fuel, communications, transportation and personnel. Also includes rating on general equipment and facilities; rating on size of effective landing area; rating on night lighting equipment. Part III is about Rating of Airports for seaplanes. Likewise, it provides for basic requirements; rating on general equipment and facilities; rating on size of effective landing area and also rating on night lighting equipment. The last part, i. e., Part IV pertains to the rating of combined land plane and seaplane airports.

Surrounding obstructions are calculated to diminish the margins by seven times the height of such obstructions. Thus an "L" shaped field having landing strips 100 ft. wide and margins of 100 ft. on both sides is sufficiently large if there are no surrounding obstructions. Should there be obstructions 50 ft. high, the margins between the obstructions and the edge of the landing strip must not be less than 350 ft.

(3) The airport must be near a good highway to the nearest city or town.

(4) The airport must have an improved type of wind-direction indicator, and be marked by day with a landing circle 100 ft. in diameter having a band 4 ft. wide, the circle to be placed flush in the center of the landing strip intersection. The name of the city or field must be in or near the center of the marking.

(5) The airport must be able to supply aircraft with fuel, oil, and water and the airmen with dependable communication and transportation facilities to the nearest cities.

Factors in the Growth and Development of Municipal Airports. Factors accounting for the growth and development of municipal airports include: (1) The Airport Committee of the Department of Commerce; (2) Improved Aeronautics; (3)

The recognition by the laws,<sup>25</sup> courts and authorities that the airport is a municipal function; (4) Other Fundamental Factors.

1. The Airport Committee of the Department of Commerce:

One of the outstanding factors in the growth and development of municipal airports has been the Airport Committee, Aeronautics Branch, of the Department of Commerce, purposely established to promote airports. The work of the Committee includes: First, directing and coordinating the work of the Department of Commerce related to assisting in the selection of and fostering the development of airports; second, promulgating the airport rating regulations and rating the airports; third, planning and preparing the airport publication;

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25. Statutory authority for the ownership and operation of airport facilities by political sub-divisions have been enacted in: California, (stats. 1927, ch. 267, p. 485, Title 12, Act 149); Illinois (L. 1927, pp. 297, 616); Indiana (Acts 1920, p. 160); Kansas (L. 1921, ch. 264, sec. 12); Kentucky (L. 1926, ch. 107; L. 1928, ch. 77, 78); Louisiana (L. 1928, Act No. 24, 225); Maryland (Acts 1927, ch. 431); Michigan (Pub. Acts 1927, No. 182, 329); Minnesota (L. 1923, ch. 34; L. 1927, ch. 62); Montana (L. 1927, ch. 20; Rev. Code Section 5039); Nebraska (L. 1921, p. 658; 1922 Comp. stat. sec. 4607); New Jersey (L. 1928, ch. 101, 181, 184); New York (L. 1928 ch. 647; amending laws 1928, ch. 169); Ohio (Gen. Code, 1926, sec. 3677, 3939); Oregon (L. 1925, p. 162, sec. 7091); Pennsylvania (L. 1923, No. 191, 192; Laws 1925 No. 328; L. 1927, Act 444); Washington (L. 1925, ch. 42); Wisconsin (L. 1921, ch. 234; Stat. 1925, sec. 6606, L. 1927, ch. 248); Wyoming (L. 1927, ch. 72).

and fourth, rendering free aid to the municipalities desiring to be informed or guided in the construction of their airports.

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2. Improved Aeronautics: Undoubtedly, improvement in aeronautics has also been a factor in the promotion and

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26. Under the Air Commerce Act of 1926, approved by the President on May 20, 1926, there was laid the legislative cornerstone for the development of civil aeronautics in America. Under this act, the Secretary of Commerce is charged, generally, with the encouragement and regulation of the use of aircraft in commerce, immediate control being under an assistant secretary for aeronautics appointed by the President. Generally, the Secretary will administer the Air Commerce Act and foster air commerce; Establish and maintain civil airways; operate and maintain intermediate landing fields, lights, signals, and radio direction finding apparatus, and other structures and facilities excepting airports used as aid to navigation; Chart airways and publish maps; Encourage the establishment of airports, airways and other air navigation facilities; Study the possibilities in the development of air commerce, industry and trade; Recommend to the Secretary of Agriculture necessary meteorological service; Collect and disseminate information relative to air commerce and the state of the art; Advise with other executive portal agencies in research and development of air navigation facilities and transfer funds; Investigate, record, and publish causes of accidents; Exchange with foreign governments civil air information; He may apply to civil air craft to such extent as he deems advisable, the laws and regulations relative to entry and clearance of assets; Upon agreement with the Postmaster General, the Secretary of Commerce may take over the airways and air navigation facilities now under jurisdiction of the Postmaster General, save airports and terminals, which may be transferred to the jurisdiction of municipalities, concerned under arrangements subject to approval by the President.

advancement of municipal airports. Aeronautical transportation has now been firmly established with a considerable degree of safety, security and reliability, and this fact has greatly accelerated the interest and enthusiasm of municipalities for the development of municipal airports.

It will be needless to point out all the instances where demonstrations of flying have caused municipalities to build, repair or plan airports. However, such demonstrations as the "State Air-tours" of Kansas and Arkansas have induced the municipalities of these states to construct their airports after witnessing the safety, security, and reliability of the art of flying. The numerous flights of Colonel Lindbergh, the various trips of the Graf Zeppelin, The Sky Fleet, etc., have taken a great part in the making of the municipalities airport-minded and have been responsible for the growth and development of airports, both municipal and commercial.

3. The Recognition by the Laws, Courts, and Authorities that the Airport is a Municipal Function: Still other factors that have been responsible for the rapid progress of municipal airports are, namely; the laws, the courts, and the authorities on aeronautics. Laws of the various states have been passed and put into operation giving their muni-



cipalities the power to establish and maintain airports.<sup>27</sup> The courts have unwaveringly sustained the constitutionality of municipal airports as constituting "public purpose",<sup>28</sup> (as shown in Chapter II); and authorities on aviation have pointed out the fact that the airport is a necessary adjunct of the municipality because of the reasons and advantages which have been stated in the early part of this chapter.

4. Other Fundamental Factors: Besides the factors that have been presented above, there are the other factors that have been instrumental in the development of municipal airports. These factors comprise various forms of business, commercial, recreational, educational, aeronautical, patriotic institutions and associations.<sup>29</sup> The significant part that Chambers of Commerce, Rotary Clubs, the American Legion Posts,<sup>30</sup> The National Airport Association,<sup>31</sup> Airport Managers

27. Hansue, H.M., Legislation for the Control of Airports. Airports II;15, 1929.

28. Chapter II of this thesis deals with the recognition by the courts that the municipal airport is a "public purpose" and hence, legitimately considered local function.

29. Promoting Airports. American City Vol. 40, January 1929.

30. The Municipal Airport of Yakoma, Washington was developed by the local American Legion Post.

31. The National Airport Association of America organized in Chicago in 1927. Airports I:14, December 1928.

Association,<sup>32</sup> the Gugenheim Foundation,<sup>33</sup> and others have rendered in the progress of municipal airports is so obvious that it will be needless here to put more light upon them.

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32. The Airport Managers Association includes the managers of the municipal airports of New York, Los Angeles, Chicago, Oakland, St. Louis, Philadelphia, Boston, St. Paul, Atlanta, Salt Lake City, and others.
33. The Gugenheim Foundation sponsored the Lehigh Portland Cement Company, "Competition for the Design of Airports in 1929." The Committee of the Competition formulated what was to be the characteristics of the modern airport, as follows: The modern airport must resemble to a considerable extent a well-equipped railroad terminal. It must provide a passenger station with ticket offices, baggage rooms, waiting rooms, public restaurant, toilets, and other commonplace facilities. It should provide an immigration and customs office, a post office, and adequate facilities for handling express and mail. There must be administration offices, not only for the various aerial transport lines which utilize the field, but for the control of flying operations at and adjacent to the port. There must be quarters for the field and flying personnel, and probably a hotel for transients as well as their permanent guests. There must be hangars for the care of planes, machine shop, fire station, gasoline and oil filling stations, an extensive and elaborate lighting system and many other service facilities required for the care and operation of planes.

As shown by the following table, of all the municipalities studied, no two municipal airports had been developed by one type of body. The table shows that officers of the Government had in most cases been responsible for their establishment. The rest had been developed by the Chambers of Commerce, aviation clubs, and citizen boards and committees.

TABLE II

## HOW MUNICIPAL AIRPORTS HAVE BEEN DEVELOPED

<u>Municipal Airport of:</u>	<u>Developed by:</u>
1. Atlantic City, N.J.	Dept. of Parks and Public Property
2. Battle Creek, Mich.	Chamber of Commerce
3. Buffalo, N.Y.	City Council
4. Centralia, Wash.	Mayor and two Commissioners
5. Cleveland, Ohio	City Manager and Director of Public Parks
6. Hartford, Conn.	Committee appointed by Mayor
7. Lansing, Mich.	Combined: State, City and C. of C.
8. Louisville, Ky.	Citizen Committee
9. Menister, Mich.	Municipal Council
10. Muskogee, Okla.	City Aviation Club
11. Pine Bluff, Ark.	City Mayor, City Engineer and Citizen Board
12. Raleigh, N.C.	C. of C. and Comm. of Public Works
13. Rochester, N.Y.	Dept. of Public Works.
14. Salt Lake City, Utah	City Board of Commissioners
15. Stockton, Calif.	City Manager
16. Wayne, Ind.	Citizen Board

## CHAPTER II

## THE MUNICIPAL AIRPORT - A "PUBLIC PURPOSE"

It is a well settled principle of local administration that the acquisition, ownership and operation of a municipal airport is a public purpose, within the meaning of the general principles of constitutional law prohibiting the expenditure of public money or the levying of taxes or the incurring of indebtedness for private purposes. This decision had been made by the courts which had occasion to consider it in 1928.<sup>1</sup>

This result is in accordance with the statutes of the various legislative bodies of the country which expressly authorize the expenditure of public funds or credit for the establishment of airport facilities by political subdivisions.<sup>2</sup> (See Chapter I, page 20, note 25) Obviously it is also in accord with the numerous regulatory enactments tacitly recognizing the governmental or public nature of the functions involved. Further it is commensurate with the regulatory legislation pertaining to aviation which

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1. Freeman, H.J., The Establishment of a Municipal Airport as a Public Purpose. National Municipal Review, April 1929.

had been provided by Congress in the Air Commerce Act of 1926.<sup>3</sup>

The first case in which the question of public purpose was presented for consideration arose in Ohio.<sup>4</sup> The litigation involved the issuing of bonds for a municipal airport.

The city of Cleveland, under express authority

2. The following legislatures have regulatory legislation pertaining to aviation: Arkansas (L. 1927, Act. 17); California (Stats. 1921, ch. 783); Colorado (Acts 1927, ch. 64); Connecticut (Pub. Acts 1925, ch. 249, L. 1927, ch. 324); Delaware (L. 1923, ch. 199); Florida (L. 1925, ch. 11 339); Georgia (L. 1927, p. 779); Idaho (L. 1925, ch. 92); Indiana (Acts 1927, ch. 43); Kansas (L. 1921, ch. 264); Kentucky (L. 1926, ch. 107); Maine (L. 1923, ch. 220, Amended by L. 1925, ch. 185); Maryland (L. 1927, ch. 637); Massachusetts (Acts 1922, ch. 534, Amending S.L. 90, sect. 35-43, Acts 1925, ch. 189, Amending G.L. 90, sect. 41); Michigan (Pub. Acts 1923, No. 224, Pub. Acts 1927, No. 138); Minnesota (L. 1921, ch. 433, L. 1925, ch. 406); Mississippi (L. 1928, Act of April 26, 1928); Nevada (L. 1923, ch. 66); New Jersey (L. 1913, ch. 50, L. 1921, ch. 124, L. 1928, ch. 63); New York (L. 1928, ch. 233, 373, 408); North Dakota (L. 1923, ch. 1); Ohio (Gen. Code 1926, sect. 1392-3); Oregon (L. 1923, ch. 186); Pennsylvania (L. 1927, Act 250); South Dakota (L. 1925, ch. 6); Tennessee (L. 1923, ch. 30); Texas (Gen. L. 1919, ch. 9); Utah (L. 1923, ch. 24); Vermont (L. 1923, No. 155); Virginia (L. 1923, Title 33A, ch. 146A); Wisconsin (1925, ch. 35); Wyoming (L. 1927, ch. 72); Island of Hawaii (L. 1923, ch. 109, Rev. L. 1925, sect. 3891-3905).

3. United States Air Commerce Act of 1926, Act of May 20, 1926, ch. 344, 44 Stat. L. 568, 49 Mason's O.S. 1761.

4. State ex. rel. Hile v. City of Cleveland, 26. Ohio App. 158, 160 N.E. 241, Decided April 19, 1927.

conferred by statute,<sup>5</sup> had undertaken to issue bonds for the purpose of acquiring and improving land for the use of an airport. The action of the city was challenged on the grounds that this was in violation of the State Constitution in that it involved a raising of money or loaning of credit to or in aid of a private corporation or company.<sup>6</sup>

The court declared in its decision that the undertaking was valid within the statute conferring express authority upon municipalities to do the things contemplated by the ordinance of the city of Cleveland. The court in summarily dismissing the contention stated:

"If an aircraft landing field was not a public utility within the meaning of the constitutional provision conferring authority upon municipalities to acquire, construct, own, lease and operate any public utility for the benefit of the inhabitants,<sup>7</sup> any doubt as to the validity of the undertaking in question was removed by the enactment of the statute<sup>8</sup> conferring express authority upon municipalities to do the things contemplated by the ordinance of the city of Cleveland, which authority to confer such power the legislature no doubt has unless prohibited by some provision of the Constitution which prohibition we are unable to find."

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5. Ohio General Code 1926, Sec. 3677, paragraph 15, Sec. 3939 paragraph 29.

6. Ohio Constitution, Act VIII, Sec. 6.

7. Ohio Constitution, Act XVIII, Sec. 4.

8. Ohio General Code 1926, Sec. 3677, paragraph 15, Sec. 3939 paragraph 29.

The next case was considered by the Supreme Court of Kansas.<sup>9</sup> This case was different from the first in that the city of Cleveland acted under express authority to establish a municipal airport, while the city of Wichita acted under implied authority.

In this litigation, the Plaintiff, city of Wichita, challenged the power of the Board of Park Commissioners in acquiring certain land lying outside of the city limits to be used for park purposes and incidentally as an airport or landing field for airplanes. The City contended that the acquisition of the property by the Board of Park Commissioners for the purposes set out was not authorized under the statute conferring the power on the same Board to acquire land deemed necessary for public parks outside of the corporate limits of the city.<sup>10</sup>

The Court, however, held that the airport was included in the park purposes for which general funds of the city could be spent.

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9. City of Wichita v. Clapp (Kansas), 263 Pac. 12, Decided January 7, 1928.  
10. Kansas Laws, ch. 117, 1927.

In the holding of the Court, it declared that:

"The park purposes may properly include a landing field for airplanes and that while the provision of the statute authorizing any city to acquire and maintain a municipal field for aviation purposes and pay the expenses of such acquisition or maintenance out of the general fund of the city<sup>11</sup> were not sufficient to authorize the acquisition of the land in question as it was situated beyond the corporate limits of the city, they were sufficient to enable the governing body of the city to maintain such an airport out of the general funds, the park including the airport, having been validly secured under the statute providing for public parks."<sup>12</sup>

It was also stated in this opinion that:

"The expression "park purposes" has been held to include a race tract, a tourist camp, boating, bathing, refreshment, lunch stands, providing bathing suits, towels and rooms for bathers, dressing pavillion, waiting rooms for street cars, refreshment and shelter rooms for the public, grand stands, ball games, base ball diamonds, childrens' play grounds, race meets, tennis courts, hotels, restaurants, museums, art galleries, zoological and botanical gardens, conservatories and many other recreational and educational facilities."<sup>13</sup>

The significance of this case is obvious. The decision has been followed by other courts which have had occasion to consider the question of public purpose in connection with the municipal airport. It undoubtedly influenced some municipalities to establish and operate municipal aviation fields.

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11. Kansas Laws, Ch. 264, Sec. 12; R.S. 3-110, 1921.

12. New Jersey Governor Opposes Leasing of Park Lands for Airports. Moore, H.A., American City XL: 129, February 1929.

13. Otis, H.G., Athletic Fields Ruled Out by North Carolina as a part of Parks. Public Management, April 1929.



The third case relative to the "public purpose" of municipal airports came upon the Court of Maryland.<sup>14</sup> The point involved the issuing of bonds for the purpose of acquiring land and improvements for establishing an airport. The plaintiff contended, among other things, that the bond issue was illegal because it was issued for purposes other than public purpose.

The Court however, in holding the bonds legal, declared:

"The Baltimore Airport bond issue is not held illegal because neither Acts of 1927, Ch. 431 authorizing it, nor ordinances passed pursuant thereto, specified rate of interest to be charged; such interest not becoming part of debt within Constitution Act 11, Sec. 7, until rate is fixed by ordinance ratified by voters, whereas such act authorizes issuance of bonds or certificates of indebtedness at different times and rates by different ordinances."

The next decision relative to the question under discussion arose in Lincoln, Nebraska, June 27, 1928.<sup>15</sup>

Unlike the other cases, the question directly involved in this litigation was whether the procedure for the electoral authorization of the airport bonds authorized by the Nebraska Law of 1921<sup>16</sup> was to be governed by the provision of the general act or by that of the Lincoln Home Rule Charter.

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14. Doughty v. Mayor and City Council of Baltimore, Md., 141, Atl. 499, decided April 11, 1928.

15. State ex. rel. City of Lincoln v. Johnson, Nebraska, 220 N.W. 273, decided June 27, 1928.

16. Nebraska Laws 1921, p. 658, Comp. Stat. 1922, Sec. 4607.

The Court, however, in sustaining the latter contention expressly stated:

"An equipped municipal aviation field is both a public service property and a public utility within the meaning of the Lincoln Home Rule Charter in or near the city, because it is a means of making aerial service available to passengers. The service includes the transportation of mail and freight. The field is furnished for a public purpose for which taxes may be imposed in the exercise of governmental powers."<sup>17</sup>

While the cases considered above bear more or less directly upon the question under discussion, and may be considered as authorities for maintaining that the establishment of an airport is a public purpose, the two cases of Missouri, namely; *Dysart v. City of St. Louis*,<sup>18</sup> and *Ennis v. Kansas City*, both decided on the same day (Dec. 6, 1928) appear to bear most directly upon the municipal airport as a public purpose. This distinct feature of these cases required extensive consideration and they are presented here accordingly.

The latter case, i.e., *Ennis v. Kansas City, Mo.*, was argued and submitted with the former, i.e., *Dysart v. St. Louis*, and as the facts and questions raised in the two cases were parallel, the decision in the *Dysart* case is determinative of all questions involved in the *Ennis* case

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17. *Dysart v. City of St. Louis, Mo.* 11 S.W. (2d) 1054, Decided December 6, 1928.

18. *Ennis v. Kansas City, Mo.* 11 S.W. (2d) 1054, Decided December 6, 1928.

except the question of the charter power, the language of the two charters with reference to the powers conferred being somewhat different.

The Court pointed out:

"The first question presented by the record is whether the proposed indebtedness of \$2,000,000 is to be incurred for a public purpose. The Constitution of this state provides that "taxes may be levied and collected for public purposes only."<sup>19</sup> This provision embodies a well settled principle of constitutional law. Even in jurisdiction whose constitution contains no such limitations on the taxing power, it is universally agreed that an attempt to raise money by taxation for private purposes is unconstitutional; that it is a taking of property without due process of law; that it violates the fundamental principle inherent in free government."

The contention of the plaintiff that the establishment of an airport was not a purpose for which taxes could be levied, was supported by the following expressive language;

"If the airport will afford a starting and landing place for a few wealthy, ultra-reckless persons, who own planes and who are engaged in private pleasure playing, they may pay somewhat for the privilege. It will afford a starting and landing place for pleasure tourists from other cities, alighting in St. Louis while flitting here and yon. It will offer a passenger station for the very few persons who are able to afford and who desire to experience the thrill of a novel and exciting mode of luxurious transportation."

The number of persons using the airport will be about equal to the total number of persons who engage

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19. Missouri Constitution, Art. X, Sec. 3.

in big game hunting trips to the African jungle and voyages and North Pole explorations.....

In the very nature of the things, the vast majority of the inhabitants of the city, a 99 percent majority cannot now and never can reap any benefit from the existence of an airport.

True, it may be permitted to the common garden variety of citizen to enter the airport free of charge, so that he may press his face against some restricting barriers, and sunburn his throat gazing at his more fortunate compatriots as they sportingly navigate the empyrean blue.

But beyond that, beyond the right to hungrily look on, the ordinary citizen gets no benefit from the taxes he is forced to pay".

The Court, however, in rejecting this contention said:

"While it is unquestionably true that the airplane is not in general use as a means of travel or transportation, either in the city of St. Louis or elsewhere yet, in view of the tremendous activity and progress in this field as described in the various opinions of the city of Wichita v. Clapp, there is small doubt that within a comparatively few years the use of the airplane will be as general as that of the railroad and motor vehicle."

The other contention against the validity of the acts of the city in attempting to establish the airport is so well settled by the court that this portion of the opinion may be well reproduced in full:

"As a further reason for insistence that an airport is not a public purpose for which the city of St. Louis may incur an indebtedness, appellant urges that the exercise of no governmental function

or corporate act is required, but that on the contrary an airport can be better provided through private initiative and by private capital. This contention is based on the holding in *State v. Orear*, that the business of making and selling ice is not a public purpose. There is, however, no analogy between the manufacture and sale of ice and the acquisition and maintenance of an airport. The latter is a necessary instrumentality in a new method or system of transportation which requires public aid for its development and final establishment. The situation with respect to it is very like that which existed with reference to the building of railroads in this country something like three quarters of a century ago. At that time the people of many of the different cities and towns were so desirous of having the benefits of railroad connection that they sought and secured authority from the legislature of their state to aid the railroads with municipal funds, either as a loan or as direct gift or by subscription to the stock, or by guaranteeing the bonds or other indebtedness of the railroad companies.

The question then arose whether a municipal corporation could be authorized to expend in this manner, funds raised by taxation. Though at the beginning there were some dissents, it finally became established by the courts that the expenditures of public funds in behalf of a railroad is an expenditure of public funds for public use. The decisions for the most part were put on the broad ground that the increased prosperity of the community which might be expected to result from the new means of travel and transportation made the purpose a public one. And so we say with respect to the expenditure of public funds for an airport."

Unquestionably this decision is of great significance to the country in general. It shows that the municipal airport is a public purpose for which public money and credit could be spent for its establishment and maintenance.

It shows that in spite of the newness of the municipal airport, it is now firmly established as an adjunct of local government just as the streets, bridges, docks, etc. And in spite of the objection of tax payers for the most part that the municipal airport should not be a public one for which public funds should be spent, the courts have considered the contrary and held that it is a public purpose.

The Court of Appeals of New York, on December 7, 1928 likewise handed down a decision declaring the issuing of bonds for municipal airport constitutional.<sup>20</sup>

The City of Utica, New York, under statutory authority of 1929,<sup>21</sup> had contracted to buy lands to be used as an airport. The City was about to issue bonds for the purchase of the land when the acts of the city were challenged on the validity of bonds.

The Court in a very brief opinion summarily held the purpose was a public one and declared that:

"The creation of an airport is a city purpose as much as the building of a bridge, a dock, or rapid transit railroad. Aeronautics is today an established method of transportation. The future, even the immediate future will make it still more general. The city that is without the foresight to build the airports for the new traffic may soon be left behind in the race of competition. Chalcedon was called the City of the Blind because its founders rejected the noble site of Bysantium lying at their feet. The need for vision of the future in the

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20. Hesse v. Roth, N.Y., 164 N.E. 342, Decided December 7, 1928.

21. New York Laws 1928, Ch. 647, Amending Laws 1928, Ch. 169.

governance of cities has not lessened with years. The dweller within the gates even more than the stranger from afar will pay the price for blindness."

The case<sup>22</sup> which was decided in Oregon was a suit brought to enjoin the city of Roseburg from issuing bonds under statutory authority<sup>23</sup> for the purpose of establishing an airport near the city. The right of the City to construct and maintain an airport at the expense of the tax payers of the community was challenged.

The Court in denying that the purpose of establishing and maintaining an airport is private rather than public, summarized the two cases previously stated and handed down upon this matter and decided on precedents. In the opinion of the Court, the following expressive language was used:

"What is a public use is not capable of an absolute definition. A public use changes with changing conditions of society, new appliances in the sciences and other changes brought about by increased population and modes of transportation and communication. We cannot close our eyes to the great growth in the use of flying machines during the past decade. This growth has been especially noticeable during the last two or three years. We must take notice that a large quantity of mail is being daily transported into the various ports of the country. Expressage and even freight is being transported by airplanes in large and rapidly increasing quantities. The transportation by air appears to be increasing so rapidly that we may confidently expect that soon a large portion of the mail and express will be transported by the airplanes.

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22. McClintock v. City of Roseburg, Oregon, 273 Pac. 331

23. Oregon Laws, 1925, p. 162, Sec. 7091.

An airport owned by the City, open to the use of all airplanes is for the benefit of the city as a community, and not of any particular individuals therein. It is therefore, a public enterprise. Aeroplanes travel the tractless air. The only way an airplane company could acquire a monopoly would be through monopolizing the airport. It would seem, therefore, that airports may be properly owned and controlled by a municipality or other public corporation. Such has been the holding of all the courts passing upon the question directly."

Conclusion: In spite of the recency of the question as to whether the municipal airport is a "public purpose", within the purview of the general principles of constitutional law prohibiting the expenditure of public money, or the levying of taxes or the incurring of indebtedness for a private purpose, there has already been established sufficient authority to warrant the conclusion that the municipal airport is a public one, for which public funds and public credit could be spent for its acquisition, construction and operation. This authority not only includes the decisions that have been presented above, but statutes of the various states have also been enacted, providing the municipalities and other political sub-divisions power to acquire, own and operate municipal airports, as well as regulatory legislation and of general public opinion as reflected therein.



### CHAPTER III

#### THE MANAGEMENT AND MAINTENANCE OF MUNICIPAL AIRPORTS

The problems that will be considered in this chapter are two-fold; First, the methods of management of the airport, and second, the methods of maintaining them. Under the first, consideration will be given to the locations of the municipal airport in the administrative scheme of city government, the manager and his qualifications, the place of women in airport management and the rules for field operation. Under the second, consideration will also be given to the financial maintenance of municipal airports and the sources from which the airport revenues are obtained.

Who Should Manage the Airport? The answer to this question has not been established. Various locations for the management of the municipal airport have been designated in different cities. Accordingly, there has not been a definite agreement as to which of them is the proper and appropriate place of administration. However, there seems to be two of these locations, namely; the Department of Parks and a separate Department of Aviation, which are claiming more supporters than the rest. The former is being used by a few larger cities, but the latter is being practiced by only one city. The writer, himself, believes that a separ-

ate department of aviation might be a good solution. This would be as efficient or more efficient than when airport management is merged with an already existing department of the city government.

Park Department Administers the Municipal Airport:

A few of the larger cities today, such as Chicago, Illinois;<sup>1</sup> Beaumont, Texas;<sup>2</sup> Cleveland, Ohio;<sup>3</sup> Buffalo, New York;<sup>4</sup> Fort Wayne, Indiana;<sup>5</sup> and Wichita, Kansas<sup>6</sup> are operating their airports under the management of the park department of their respective cities. The reasons for locating the airport to be administered under this particular department have been very well stated by Wirth,<sup>7</sup> as follows:

"(1) It has been conceded by the Supreme Court of Kansas that the municipal airports serve recreational as well as commercial purposes, and the management of such airports is therefore a proper function of park administration.

(2) The park department may have in its possession grounds adapted for such purposes. If this is

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1. Wright, W., Chicago's Municipal Airport An Institution. Airport 1:27, 1928.
  2. Whitbeck, Airports as a City Problem. Public Management XI:147.
  3. Air Commerce Bulletin No. 21, Department of Commerce, Aeronautics Branch, Washington, D.C.
  4. Ibid.
  5. Ibid.
  6. City of Wichita v. Clapp (Kansas) 263 Pac. 12, January 7, 1928.
  7. Wirth, I., The Park Department as the Operator of Airport. American City 39:110.

not the case, it has power to acquire lands for such a port.

(3) A municipal airport in order to serve its purpose well and be a credit to the municipality, must be landscaped and made attractive, sanitary, and serviceable to a high degree, just as any other park system, and the park administration is already equipped to fulfill such requirements.

(4) The real needs of the public in the proper use of the field must be provided and protected, and the service to the people properly arranged for and controlled, all of which is a function that the park department exercises over its other properties and which it is therefore competent to render."

A Separate Department of Aviation: The creating of separate department of aviation to look after the management of the municipal airport has been the progressive venture of the City of Miami, Florida.<sup>8</sup> It is a bonafide department of city administration and it is managed by a director.

The advantages of such a separate department of aviation may be considered as follows: (1) It avoids crowding other operating departments in their local obligations and duties; (2) The magnitude and complexity and distinct technicality of the work of the aviation department requires the creation of a separate department; (3) A separate office for the operation and management for the airport may be more efficiently performed if it is under an independent department of its own; (4) The increasing volume of the work

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8. Whitbeck, J.E., Airports as a City Problem. Public Management XI:147.

of the airport executives demands that an independent department of administration should be established.

Other Methods of Management of Airports: Other methods of management of airports are shown by a study of the Department of Commerce, Aeronautics Branch.<sup>9</sup> The municipal airport of Stockton, California is managed by the City Manager; Centralia, Washington is under the Commissioners of Public Works; Raleigh, North Carolina is directly administered by the City Commissioners; Lansing, Michigan is managed by a Committee of five citizens; and Medford, Ohio is under the joint management of the County and City officials.

The Manager and His Qualifications: The management of the airport is a profession in the same class with the superintendent of an institution, the president of a bank, the manager of a store, or the head of a railroad system.<sup>10</sup> Hence the director or manager should have executive ability to assume the position. Gerard gives a list

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9. Air Commerce Bulletin No. 21, Department of Commerce, Aeronautics Branch, Washington, D.C., March 31, 1928.
10. McCracken, Assistant Secretary of Commerce for the Aeronautics Branch in discussing airport management said: "The management of the airport is a problem which is so new---. It is very difficult to give much advice. It is primarily a matter of the personality of the man at the present time---. At this time it is a matter of system as it is a matter of the competency of the personnel in charge." Public Management XI:248.

of the qualifications:

"(1) As a rule the manager must be versatile in his profession. He should know the rudiments of flying and mechanics as well as aircraft construction, operation and maintenance. He must have a knack for handling employees as well as that of running a business whose phases are many and varied.

(2) An airport manager must understand the problems that confront the pilot, mechanic and operator. He must also have some knowledge of meteorology, and be able to work hand in hand with airport engineering experts. This means that he must have a knowledge of airport drainage, lighting, and maintenance.

(3) The management of an airport does not only consist of merely sitting behind a desk and giving orders. As in every other business, it requires that the man who gives orders, gets busy and sees that they are carried out, and if it is necessary, helps carry them out. He must be able to do a thing himself before he is qualified to tell some one else how to do it."<sup>11</sup>

The Place of Women in Airport Administration:<sup>12</sup> There are two fundamental ways in which women can help in the efficient management of an airport.<sup>13</sup> These are the business phase and the social phase. In the former, women could fill offices, namely; telephone operators, secretaries, stenographers,

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11. Gerard, F., Facilities for Training Airport Managers. Airports 2:17.

12. Krafft, M., Women Places at the Airport. Airport 2:13 February 1929.

13. Omlie, P.F., Woman's Activities at the Airport. Airport 2:33, March 1929. This authority concludes her article with this sweeping statement: "It is needless to say what women will do in the future development of airports. They will be as prominently identified with progress as the men."

clerks, bookkeepers, and others. In the latter, i.e., the social way, women can serve as airport hostesses. This position, that of women hostesses as at hotels, recreation centers, clubs, and other amusement places, will undoubtedly make the atmosphere of the airport more pleasant and complete. The significance of women hostesses is increased, due to the fact that aviatrixes or women pilots as well as women passengers are frequenting the air for travel. In this capacity the hostess will welcome and receive fliers and air travelers from far and near points whose visits become more frequent because of this personal tribute paid to their comfort.

Airport Field Rules: At the present writing, the cities of Oakland, California; Richmond, Virginia, Saint Joseph, Missouri; San Antonio, Texas; Battle Creek Michigan; Buffalo, New York; Bartlesville and Muskogee both of Oklahoma have established field rules for their municipal airports.<sup>14</sup> The first four of these cities have passed ordinances to enforce their respective field rules and also to put into effect the regulations and air traffic rules of the Department of Commerce. The others have put their field

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14. Air Commerce Bulletin No. 21, Department of Commerce, Washington, D.C., March 31, 1928.

rules into operation without the passage of specific ordinances.

Apparently these field rules have been modeled after those that were formulated by the Department of Commerce as shown by their nature and content,<sup>15</sup> hence, it has been found very appropriate to incorporate the latter below:

(1) All aircraft pilots and mechanics operating commercially from this field must be licensed by the Department of Commerce and must comply with the Air Commerce regulations promulgated by that department.

(2) Upon landing, pilot will assure himself that there is no danger of collision with air craft taking off or landing before taxi-ing to line.

(3) No plane shall be taxied faster than five miles per hour.

(4) No airplane shall be fueled while the engine is running.

(5) Blocks shall always be placed in front of the wheels of the plane before starting engine.

(6) All blocks shall be equipped with ropes or some other suitable means of pulling blocks.

(7) No engine shall be started or run unless the pilot or other competent person shall be in the cockpit attending controls.

(8) In starting an aircraft engine, the customary proceedings will be used by the person operating the starting device and the person at the engine controls. All challenges or signals between the former and the latter shall be clearly understood before action is taken by either.

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15. Air Commerce Bulletin No. 21, Department of Commerce, Washington, D.C., March 31, 1928.

(9) Pilots will land and take off as far from the hangar or parking space of aircraft as it is practicable.

(10) An aircraft will not follow in the wake of another aircraft which preceded it in taking off until such aircraft has gained a safe distance.

(11) Aircraft shall not take off over hangars, buildings, or other obstructions unless unavoidable.

(12) An aircraft when making a landing shall not land toward another aircraft but shall land to either side of such aircraft.

(13) The propellers of aircraft, when engines are not running, must be in horizontal position.

(14) On test flight of aircraft, the personnel making such flights will not be limited to the number necessary to properly perform the required test. At no time shall persons be carried on such flights as ballast.

(15) Airport managers should send accident reports to the Department of Commerce for all accidents occurring in their field.

(16) All dangerous landing area at an airport or landing field shall be marked with red flags mounted on staffs of light material, at least 4 ft. above the ground. The staffs shall be of such material as will not cause damage to aircraft if struck. The flags shall be replaced by red lights at night.

(17) All obstructions shall be marked at night with red lights.

(18) All persons using in anyway the airport area shall exercise due care to guard against fire, and injury to persons and property. No rubbish shall be scattered about the airport area and the crew of all visiting aircraft shall be required to keep clean the space allotted.

(19) Aircraft must be parked in the space allotted



and shall be properly secured by ropes and stakes, or otherwise when left unattended over night or during weather conditions which indicate the necessity of it.

(20) No plane shall remain on runways longer than is absolutely necessary in flying operations. The runways shall be kept clean of obstructions to planes at all times and the runways shall be used solely for the landing and taking off of air planes.

(21) Lighting of the airport for night flying shall be done only to meet the requirements of the United States Department of Commerce and the air mail service. If additional night lighting is desired, the operating authorities shall be duly notified.

(22) All visiting pilots landing on this field are requested to report immediately to the administration office on the port to register their names, addresses, type of equipment, license or military number of aircraft, its ownership, the time of their arrival, expected time of departure, service required, and such other information as may properly be required for record purposes.

(23) It is hereby made the duty of every pilot, mechanic, or other person employed on the field, and they are hereby authorized to carry out these rules and also to see that the general public uses due care and caution to prevent injury to themselves and other persons or property and equipment of whatever nature on the field.

(24) Landing and take offs shall be made, when practical into the wind. The party in charge of operating the airport shall designate the runway to be used and the direction of take off and landing.

TABLE III  
AIRPORT MAINTENANCE<sup>16</sup>

(Explanation of this table is found on page 49)

City	Municipal or City appropriation	City and county appropriation	City and State	Aero Club	Commercial line operator	Municipal and Civic Organization	Municipal Appropriation and their revenue	Rents from private operators	Civic Organization	Municipal and from hangars rental
Atlanta	X									
Battle Creek									X	
Boston			X							
Buffalo							X			
Cincinnati						X				
Cleveland	X									
Fort Worth	X									
Grand Rapids					X					
Hartford			X							
Los Angeles	X									
Muskogee				X						
Pasco								X		
Philadelphia	X									
Phoenix	X									
Pittsburg		X								
Portland	X									
Santa Monica	X									
St. Joseph										X
Tuscon	X									

16. Data derived from Table III (Data on Airport Cost and Maintenance) Duke, A., op. cit. P. 33.

Financial Maintenance of Municipal Airports: A study made of nineteen representative municipal airports shows that there are at present various ways of maintaining municipal airports. For instance, of these nineteen municipal airports, nine are maintained by city or municipal appropriation; two are maintained by the combined appropriations of the city and state; and one airport each is maintained by the city and county combined; aero club; commercial air-line operator; municipal and civic organization; municipal appropriation and through revenue derived; private operator's rents; and civic organization.

The common practice of maintaining municipal airports is by municipal or city appropriation. This seems to be the logical and most advantageous method and it is followed by the more progressive cities. The table on the preceding page shows the methods of maintaining airports and also which cities are operating under each type.

Airport Revenues: As far as can be determined, the only ways by which municipal airports obtain revenues are from charges for storage and service.<sup>17</sup> These practices, however, are not yet common to most of the municipal air-

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17. Air Commerce Bulletin No. 21, Department of Commerce, Washington, D.C., March 31, 1928.

ports.<sup>18</sup> A study made recently by the Department of Commerce of 114 municipal airports shows that less than one quarter of this number has established the following rates:<sup>19</sup>

Landing fees-----None, save one instance, where the charge is \$1.00

Daily rates-----Range from 50 cents to \$3.00 average daily for single planes; \$3.00 for multi-engined planes.

Monthly rates-----Range from \$10.00 to \$50.00 average for single engined planes. (In several cases inspection and service are specifically included)

Dead storage-----Several airports schedule dead storage at \$15.00

Field storage-----Field space is mentioned by several ports at \$1.00 daily; \$20.00 monthly. (In the main field, storage is apparently free.)

Multi-engined planes---Several consider two types. One rates such planes at \$150.00 a month, cabin planes at \$75.00, and tri-engined planes at \$150.00

The study also shows that among these cities that have established charges for storage and service, three cities, namely; Buffalo, Fort Worth and Oakland, have developed and

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18. Have You a Fixed Charge for Storage and Repairs. Airport 1:28, July 1929.

19. Air Commerce Bulletin No. 21, Department of Commerce, Washington, D.C., March 31, 1928.

put into operation comprehensive schedules such as the following:

### BUFFALO, N.Y.

#### Price per square foot

	:per :year	:6 Mo.- :1 Yr.	:1-6 Mo. :(per :week)	:1 day- :1 week :(per :week)	:
Airplane manufacturers	:\$0.58	:\$0.06	:\$0.03	:\$0.005	:
Commercial operators	:.50	:.05	:.02	:.005	:
Private	:.40	:.04	:.015	:.0025	:
Army and Navy	:No charge for three days or less				:

Dead Storage: For private planes, one half active schedule.  
Non-resident: Transients desiring hangar space for not longer than one week will be charged at the same rate as the private owner.

### FORT WORTH, TEXAS

#### Flat-rate schedule

	:Live stor- :age with :service :per mo.	:Live stor- :age with- :out service :per month	:Dead stor- :age per mo	:Mechanic's :labor per :hour	:
Single engine	: \$50.00	: \$25.00	: \$15.00	: \$2.00	:
Multi-engine	: 75.00	: 50.00	: 30.00	: 2.00	:

## OAKLAND, CALIFORNIA.

Charges, tools, and rates for service.

Landing fee including storage of plane on ground for one day or graction thereof-----	\$1.00
Daily Storage fees, including landing privileges:	
Hanger space-----	\$2.00
Ground space-----	1.00
Passenger fee, for each passenger carried for hire, except in transit-----	\$ .50
Monthly storage fees, including landing privileges:	
Hanger space-----	\$40.00
Ground spsce-----	20.00
Mechanician services	
For straight time (8 to 4:30) per hour-----	\$1.50
For over time----- " " -----	2.00

No landing fee shall be collected from planes engaged in the service of the United States Army, Navy, or the Marine Corps, or the United States Department of Commerce, or from planes carrying the United States mail.

As to which of these schedules is preferred, there has been no definite agreement. It remains for the individual cities to formulate their own to suit and fit their individual circumstances. If air traffic demands that comprehensive schedules should be made, reference might be made to these schedules which are in actual operation for information and guidance.

Other Sources of Income: Aside from the hangar rents or storage, charges and service charges, several items that might be mentioned as sources of revenues are: (1) gasoline and oil sales; (2) recreation halls, roadside refreshment stands, automobile parking or other concessions;<sup>20</sup> (3) revenue from periodic flying meets; (4) miscellaneous items of minor importance.<sup>21</sup>

The question might be raised as to whether: (1) these sources of revenues are sufficient to maintain the airport, and (2) will the money expended for its construction and operation be repaid from the benefits obtained by the use of the airports? The writer will not attempt to answer these questions categorically. However, he believes that for the present (1930) no municipal airport is on a paying basis, i.e., it is not self supporting. The initial expenditure

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20. Kelly, F., Tomorrow's Airports. Nation's Business XVII:31, Kelly believes that revenues could be increased by making the airport a civic center. He states: "I believe an airport can be made a real civic center, a place for recreation and entertainment as well as for the business of flying, a place citizens may visit with pride and where they may spend idle hours pleasantly. I know no reason why athletic fields, swimming pools, dance halls, indoor and outdoor restaurants, a hotel, boating, a park system, a model community, good transportation facilities and parking space for planes and autos cannot be developed."
21. Black, A., Civil Airports and Airways. Simmons-Boardman Co., N.Y., 1928.

for its construction and equipment could not be obtained within the first two or more decades of its existence. Like any other large scale undertaking, for example, the railroad, street cars, etc., the airport also will take years before it could make itself pay for the enormous sums invested for its construction, maintenance and operation.<sup>22</sup>

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22. Ronne, Director of Buffalo Municipal airport believes: municipal airports unlike most other city adjuncts, can be made self sustaining and even pay a return on the investment. Ronne, E.M., Buffalo Makes it Pay. Airport 1:12, June 1928. See also Aircraft Yearbook 1927.



## CHAPTER IV

## AIRPORT FACILITIES AND EQUIPMENT

Essential Equipment Needed: In order to attain a considerable degree of safety, efficiency and security of air transportation, it is very essential that the airport should be adequately provided with all the pertinent needs of aviation.<sup>1</sup> These needs include: (a) Buildings for administration and operation, (b) Transportation facilities, (c) Communication lines, (d) Meteorological instruments, (e) Runways, (f) Drainage, (g) Wind-direction-indicator, (h) Lighting system, (i) Markings, (j) Fire-fighting apparatus, (k) Signs, (l) Siren, (m) Airway maps and airports records, (n) Other maintenance and general equipment facilities.

At the present writing no civil airport as far as can be determined has yet provided itself fully with sufficient equipment. The volume of business in civil air transportation has not yet warranted the establishment of very extensive airport equipment. Even where more varied equipment had been desired, the expense of acquisition and

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1. Brinkley, R.J., Equipping the Airport, Airport 1:13  
September 1928.

construction had often been prohibitive. Municipalities in most cases have lacked available funds to finance such additional airport expenditures. Moreover civil airports have not yet shown any considerable regard for the efficiency of service and for the possibility of rapid expansion at this stage of civil aeronautics.

The average airport, however, can promote air commerce and transportation without providing itself with all the equipment listed above. While a few American airports, usually owned by the larger cities, and some European airports<sup>2</sup> are more fully furnished, the majority of the municipal airports in the United States are on the average level. It is astonishing, however, to see how much they have contributed to the advancement of civil aeronautics.<sup>3</sup>

No attempt has been made to list the equipment above in the order of their importance, and they will be considered as they have been listed.

(a) Buildings for administration and operation:

The number and sufficiency of necessary buildings for the efficient administration and operation of a particular air-

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2. Dominian, L., The Litorio Airport at Rome. Airport 2:18 January 1929.

3. Air Commerce Bulletin No. 1, Department of Commerce, Washington, D.C., March 15, 1928.

port depends to a great extent upon its character, its development, volume of traffic handled, amount of business transacted, and perhaps other minor considerations. The desirable buildings that the average airport ought to establish, therefore, could not be determined with accuracy. However, a fully equipped airport in the future will probably need the following buildings:<sup>4</sup> (a) hangars, (b) repair shops, (c) gas and oil stations, (d) shed for storage of oils, paints, and other such materials, (e) manufacturing buildings, (f) garages, (g) administration, control tower and office, (h) restaurant, (i) passenger waiting rooms and comfort stations, (j) club house for flying clubs, (k) pilots' building with lockers and showers, (l) hotel or sleeping accommodations, (m) radio building, (n) post office, (o) freight ware-house, (p) hospital or first aid dispensary buildings, and (q) recreation parlors.

In this list the most desirable are: first, the administration, control tower and office; second, hangars; third, repair shops; fourth, gas and oil stations; and fifth, passenger waiting rooms and comfort stations. These have been selected from the standpoint of immediate necessity.

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4. The Committee on the Lehigh Competition for the Design of Airports requires the buildings here mentioned. (From Editorial Service of Taylor, Rogers & Bliss, Inc., 40 E. 49th St., N.Y., March 1929.)

The rest are for the present not warranted in most cases.<sup>5</sup>

Many airports of today have provided only a few of the buildings that have been listed. The practice seems to be to establish a central building to house the needed rooms and offices so that the expense for the erection of separate buildings may be avoided.<sup>6</sup> This is a sound procedure, but wherever it is possible it is suggested that, in planning the building program, probable needs for future development and expansion should be given sufficient consideration. This will facilitate provision for improvements and will perhaps require less expenditures for the same.<sup>7</sup>

(b) Transportation facilities: Due to the distance between the airport and the business district of the community which has varied from one quarter of a mile to eighteen miles,<sup>8</sup> it is obviously important that adequate facilities for the transportation of passengers and cargoes to the business district and other points of destination should be provided for in connection with the airport. Slow and in-

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5. Duke, D., Airports and Airways, Ronald Press & Co., N. Y., 1927.

6. Black, A., Civil Airports and Airways, Simons-Boardman Publishing Company, 1928.

7. Ibid, London Makes a Mistake, American City 34:263-4, March 1926.

8. Average Distance of Airport from City is Three Miles, American City, 39:110, November 1928.

adequate methods of land transportation are not in conformity with the rapidity of air transportation. Hence, facilities like busses, taxis, and street cars should be provided systematically for the airport for transportation purposes.<sup>9</sup>

In most airports, private companies are now taking charge of the transferring of passengers and cargoes to places of designations.

(c) Communication lines: Some one has said that the key to the progressive airport is the equipping of the airport with communication facilities.<sup>10</sup> The telephone, telegraph, telephone printer, wireless, and the radio have all been considered as important for the fully equipped airport. The telephone and the telegraph are sufficient for the average airport although the other facilities are desirable.<sup>11</sup>

(d) Meteorological instruments: It is of prime importance that in order to avoid some of the accidents which

9. Bullard points out that, "the business an airport does depends in no small measure upon the land transit facilities between the port and the communities it is to serve. The business done by the port if the future prosperity of the city it serves is assured, depends to a marked degree, upon the thought and care exercised in the selection of the site and the work that is done to enhance its accessibility." Bullard, J.E., Land Transit for Airports. Airport 1:13, January 1928.

10. Gregg, W.R., Weather Service at Airports, Airport 1:11 July 1928.

11. Brinkley, R.J., The Airport as the Communication Base, Airport 2:11, February 1929.

are caused by bad weather conditions and fogs, meteorological instruments like the thermometer, the barometer and the barograph should be provided for the airport.<sup>12</sup> These instruments, of course, will answer questions pertaining to the magnitude and trend of the atmospheric pressure, the speed, direction and gustiness of wind; the outdoor temperature and its trend; the amount of moisture in the air; and the temperature in the hangers and offices.<sup>13</sup> Such information in the airport would to a certain extent eliminate the dangers that are due to bad weather.<sup>14</sup>

Most airports at the present writing are not provided with all of these instruments. The weather information is usually obtained from the local weather bureau or from another nearby city.

(e) The runways: Runways<sup>15</sup> are of two kinds, namely; natural and artificial.<sup>16</sup> The former consists of the grass sod<sup>17</sup>

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- 12. Gregg, W.R., Weather Service at Airports. Airport 1:11 July 1928.
  - 13. Newell, F.A., Airport Weather Instruments. Airport 1:27, December 1928.
  - 14. Gregg, W. R., Meteorology as an Aid to Safe Flying. Airport 2:11, January 1929
  - 15. Miller, W.P., Runways. Airport 2:9, March 1929.
  - 16. Arend, A.D., Construction of Runways to Meet the Demand. Airport 2:17, January 1929.
  - 17. Melady, J.H., Turf for Airports. Airport 1:28, June 1928. See also Blackael, A.C., Why Britain Uses Grass for Runways. Airport 1:38, September 1928.

and the latter is either of asphalt,<sup>18</sup> or brick,<sup>19</sup> or concrete,<sup>20</sup> or cinder,<sup>21</sup> or gravel,<sup>22</sup> or macadam,<sup>23</sup> or iron slag.<sup>24</sup> Natural runways are more prevalent than artificial runways today.<sup>25</sup> Several advantages are derived by adopting the grass sod as runways.<sup>26</sup> For instance, there is less expense in constructing it than the artificial. And it has been proved also that it as good a runway as the artificial, provided it is sufficiently drained to keep it from

18. Pennybacker, J.E., Runways of Asphalt. Airport 1:7 September 1928. (Airports with asphalt runways include Selfridge Field, and Mt. Clemence, Mich., Jacksonville, Fla., Portland, Ore.)
19. Campbell, O.A., Runways of Brick. Airport 1:8, September 1928.
20. Trainor, L.S., Runways of Concrete. Airport 1:9, September 1928. Trainor mentions good qualities of concrete as good runways: (1) Firmness and uniformity under all conditions of weather and temperature, (2) Smoothness and regularity, (3) Good visibility without glare in the day time and ease of illumination at night, (4) Durability and freedom from frequent maintenance, (5) Economy of construction and upkeep.
21. The municipal airports of Woodward Field, Salt Lake City and Chicago have runways of cinder. Lane, D.R., Anent the Runway. Airport 1:13, October 1928.
22. Bakersfield, Calif., municipal airport has runways of gravel. Lane, D.R., Anent the Runway. Airport 1:3, October 1928.
23. City Airport of Dayton, Ohio, has runways of macadam. Mills, C.B., Selection of Seeds for Airfield Turf. Airport 2:15, March 1929.
24. Woodblocks are also considered for runway purposes. (See note 20)
25. Martin, G.E., Runways of Tarvia. Airport 1:30, September 1928.
26. Wood, R.C., Foreign Officials Express Runway View Points. Airport 2:16.

getting muddy.<sup>27</sup>

In the construction of the artificial runways the qualities of firmness, smoothness, good visibility, and durability should be considered adequately. Wherever it is possible two runways might be provided; one for taking off and another for landing. Where this is financially prohibited, one runway for both purposes would perhaps serve just as well.

(f) Drainage system: Drainage systems also are of two kinds; the natural and the artificial.<sup>28</sup> The functions of either system is to remove surface waters from the field and from run-off from roofs, roads, and other areas.<sup>29</sup> An artificial drainage system removes and controls soil water, whether resulting from rainfalls, springs or seepage from adjacent land.<sup>30</sup> Where no natural drainage is in operation, it is desirable that artificial drainage system should be established.<sup>31</sup> So far as can be determined, not very many airports are provided with artificial drainage systems.<sup>32</sup>

27. Radway, F.S., Climatic and Soil Conditions Govern Seed Selection. Airport 2: March 1929.

28. (See note 20)

29. Miller W.P., Drainage. Airport 1:17, Movember 1928.

30. Kellogg, F.J., Natural and Improved Drainage System. Airport 2:17, March 1929.

31. Calvin, C.M., Soil Considerations for Airport Drainage. Airport 2:11, March 1929.

32. Municipal airports equipped with artificial drainage systems are those of Oakland, Sand Point, Seattle, Bettyfield. (See note 20).



(g) Wind-direction-indicator: The importance of the wind-direction-indicator has been increased when it was provided in air traffic laws that no cross-wind landings or take-offs should be made except for emergencies, or for instruction or for test purposes.<sup>33</sup> It is therefore evident that all airports must have wind-direction-indicators.

(h) Lighting system: A system of lights consisting of the airport beacon, the boundary lights, the field flood lights system, the obstruction lights, the wind-direction-indicator illuminator, signal lights and flood lights for the hangars and roof markings has to do in making the airport serviceable at night and foggy mornings as well as during the day time.<sup>34</sup> Obviously, accidents shall be reduced to a considerable minimum and also more efficiency will result for air commerce and transportation.<sup>35</sup>

The airport beacon is used to designate to a distant night flier the location of an airport or to serve as a guide

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33. Air Commerce Bulletin No. 16, Department of Commerce, Washington, D.C., January 1, 1929.

34. Blee, H.H., Designing Safe and Adequate Airports. Airport 1:15, December 1928.

35. Mahan, H.E., Airport Lighting. Municipal News LXXIV, No. 1, January 1928. Mahan believes that: "The success of commercial aviation demands that operation be continued throughout the hours of darkness and in providing artificial light during this period that no added hazards be introduced to interfere with the safe and practical conduct of port activities."

to a night air traffic along an established line of travel.<sup>36</sup> It has a light that could be distinguished easily from the ordinary lights of the city. This makes the city easily discerned and also the position of the airport is very well located. The beacon is usually revolving. From an estimate of the Department of Commerce of the number of municipal airports of January 1929, there were 49 municipal airports that have beacons of some kind.

The boundary lights show the outline of the landing area.<sup>37</sup> The circuit may be series or multiple. For large fields the series circuit with a constant current transformer is probably more economical. Where the entire field is not available for landing, green lights should be used to indicate the best approaches, being so placed that they may be aligned from the air to show the landing direction. The boundary lights should show to the flier the bounds of the airport and especially the direction of the landing strips.

The field flood light system has to do with illuminating the whole field so that the details of the surface from a certain height (usually 30 ft.) could be seen dis-

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36. Carey, W.N., The Beacon. Airport 1:33, September 1928.

37. Clarke, A.A., Boundary and Obstacle Lights. Airport 1:17, June 1928.

tinctly. This undoubtedly avoids accidents during dark nights and foggy mornings. It is of prime importance that the field flood light system employed should provide even illumination over the entire portion of the land area that is usually used for landing and taking-off. It is also necessary that the light used should not glare to blind the pilot. And when the whole system is lighted it should be able to show the irregular surfaces of the field.

The obstruction lights are for indicating to the flier the obstructions that are found within and adjacent to the airport.<sup>38</sup> Such obstructions as telephone, telegraph and power poles, radio masts, tall buildings, windmills, trees, and others should be so indicated that any danger should be avoided. These lights are usually red. In the installation of these lights care must be taken so that they will never fail when they are lighted, and also they must be fitted and installed where they could be very well seen from all angles. It is further advocated that major obstructions should be provided with duplicate lights so arranged that the stand-by light is placed in operation should the service obstruction light burn out. This will

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38. Clarke, A.A., Boundary and Obstacle Lights. Airport 1:17, June 1928.

prevent the flier from climbing or hitting prominent structures at night.

The wind-direction-indicator illuminator renders the wind-direction-indicator visible to the pilot so that he may know the direction of the prevailing wind. This is very important because pilots by rule take-off and land against the prevailing wind. By illuminating the indicator, the flier will land or take-off with more facility and safety even during dark nights and foggy mornings.<sup>39</sup>

Although the amount of traffic over the airport does not warrant the use of signal lights at the present, it is now very evident that the increasing volume of air traffic and air commerce may some day necessitate the installation of signal lights. These are used to inform the pilot who is attempting to make a landing that another airplane is ready to take-off, and that the former must give way or postpone landing until airplanes taking off have cleared the way. In this way the dangers of collision could be avoided. Much more now and in the immediate future is the importance of these lights realized because several planes are now taking-off and landing at the same time.

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39. Kellett, W.W., Lighting Problems. Airport 2:39, January 1929.

The providing of flood lights for the hangars and roof markings assists the pilot in two ways: First, it will assist the pilot to judge his elevation above the field when landing at night, and second, the pilot will be able to know the name and direction of the airport, of the city, and also perhaps the direction of the nearby airports and landing fields, by being able to see clearly the signs on top of hangars and roof of buildings.

(i) Markings: Markings of the airport has to do with two main objectives, namely; to avoid accidents, and to guide pilots during flights, landings, and taking-offs.<sup>40</sup> It is therefore necessary that tall buildings, boundaries of the field without boundary lights, factories, landing fields, telephone and telegraph and power poles, radio masts, cross trees on poles, and other kinds of unsafe areas and obstructions which may be detrimental to pilots should be marked chrome yellow.<sup>41</sup>

(j) Fire-fighting apparatus: The need of fire-fighting apparatus within the airport area could not be over emphasized.<sup>42</sup> The limited supply of available water

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40. Black, A., op. cit. p. 42-45.

41. Fawcett, W., Why Yellow for Airport Marking. Airport 1:9, December 1929.

42. Kimball, N.F., Fire Protection For Airports. Airport 1:9, June 1928.

at many airports; the presence of highly combustible number of buildings and their contents; the present construction of most airplanes which is of wood and fabric; and the indispensability of inflammable necessities such as gasoline, oil, grease, and other inflammable liquids, all make it very important that adequate equipment for fighting fire should be available at the airport.<sup>43</sup>

The most desirable fire-fighting equipments consist of water systems engines and plenty of hand extinguishers. If these are provided, they should be placed where they would not freeze. The hand extinguishers should be placed in every building and if it is possible, frequent inspections of them must be made to guarantee that they are in proper condition.<sup>44</sup>

(k) Signs: For efficient administration, the airport should be equipped with various kinds of caution signs, such as for prevention of fires, for sanitary purposes, for silence purposes, for safety ends, and for other aims and objectives that the administration desires to be observed within the airport.

(l) The siren: The siren is also being considered

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43. Timpson, L.G.M., Airport Buildings and the Fire Problem. Airport 2:12, February 1929.

44. Black, A., op. cit. p. 113-122. Also Duke, D., op. cit. p. 43.

as one of the most essential equipments.<sup>45</sup> It is usually for signalling all kinds of dangers and for emergency calls. It may also be used as time announcer.

(m) Air maps and airport records: The airport should also be provided with abundant airway maps and airport records. The former shows the pilot the direction of the airway just as the road maps show the tourist the best roads to follow to his destination. Or if in case of emergency, the flier will be able to determine the next emergency field on the lighted airway if travelling at night. By these maps, together with the weather information, dangerous zones which are often caused by storms, fogs, or other wind currents and eddies could be avoided and accidents eliminated.<sup>46</sup>

(n) Other maintenance and general equipment facilities: Other facilities that may be desirable include electric power, water and oil heaters, electric tools, small tractors, lawn mowers, snow plows, barrel racks, wheel chocks, engine starters, first aid kits, megaphones, and similar accessories.<sup>47</sup>

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45. The Siren. Airport 1:12, July 1928.

46. Duke, D., op. cit. p. 97-102.

47. Black, A., op. cit. p. 88-99

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